CLAIMS

1. A turbine blade comprising:

an airfoil integrally joined to a supporting dovetail;

said airfoil including opposite pressure and suction sidewalls extending chordally between opposite leading and trailing edges and in span from a root to a tip, an internal cooling circuit, and thermal barrier coating covering external surfaces of said airfoil pressure and suction sidewalls;

said cooling circuit including a first flow passage disposed directly behind said leading edge, followed in turn by a second flow passage separated therefrom by a bridge integrally joined to said pressure and suction sidewalls;

said bridge including a row of impingement apertures for discharging air from said second passage into said first passage in impingement behind said leading edge;

said suction sidewall including a row of diffusion film cooling first holes extending therethrough in flow communication with said first passage, and said first holes being disposed through said suction sidewall at a compound inclination angle with a quadrilateral cross section forming a generally teardrop shaped outlet in a convex contour of said suction sidewall, with said teardrop outlet extending through said thermal barrier coating;

said airfoil tip including squealer ribs extending outwardly from said pressure and suction sidewalls forming a recessed tip floor therebetween;

said tip floor including rows of floor holes along both said pressure and suction sidewalls inboard of said squealer ribs; and

said pressure sidewall includes an axial row of tip holes disposed below said squealer rib thereat.

2. A blade according to claim 1 wherein said first holes each includes a uniform inlet extending through said suction sidewall from said first passage, followed in turn by said teardrop outlet diverging therefrom.

3. A blade according to claim 2 wherein said teardrop outlet includes a substantially

straight side aligned along said airfoil span in said row of first holes, and two inclined sides extending therefrom toward said leading edge and joined together by an arcuate side along said convex contour.

4. A blade according to claim 3 further comprising a row of diffusion film cooling second holes extending through said suction sidewall adjacent to said row of first holes, and said second holes being disposed through said suction sidewall at a compound inclination angle with a quadrilateral cross section forming a generally teardrop shaped outlet in said convex contour of said suction sidewall.

5. A blade according to claim 4 wherein said second holes each includes a uniform inlet extending through said suction sidewall from said first passage, followed in turn by said teardrop outlet diverging therefrom.

6. A blade according to claim 5 wherein said teardrop outlet of said second holes includes a substantially straight side aligned along said airfoil span in said row of second holes, and two inclined sides extending therefrom toward said leading edge and joined together by an arcuate side along said convex contour.

7. A blade according to claim 6 wherein said row of second holes is staggered with said row of first holes along said airfoil span.

8. A blade according to claim 7 wherein said first and second holes overlap along said airfoil span to provide a continuous line of film cooling air discharged therefrom along said airfoil suction sidewall.

9. A blade according to claim 8 wherein said first and second holes have substantially equal outward inclination span angles along said airfoil span greater than about 45 degrees, with said outlets being closer to said tip than said corresponding inlets.

10. A blade according to claim 9 wherein:

said first and second holes have different inclination chord angles along said suction sidewall greater than about 45 degrees, with said outlets being closer to said trailing edge than said corresponding inlets;

said row of first holes consists of twelve holes; and

said row of second holes consists of thirteen holes.

11. A turbine blade comprising:

an airfoil integrally joined to a supporting dovetail;

said airfoil including opposite pressure and suction sidewalls extending chordally between opposite leading and trailing edges and in span from a root to a tip, and having an internal cooling circuit;

said cooling circuit including a first flow passage disposed directly behind said leading edge, followed in turn by a second flow passage separated therefrom by a bridge integrally joined to said pressure and suction sidewalls;

said bridge including a row of impingement apertures for discharging air from said second passage into said first passage in impingement behind said leading edge; and

said suction sidewall including a row of diffusion film cooling first holes extending therethrough in flow communication with said first passage, and said first holes being disposed through said suction sidewall at a compound inclination angle with a quadrilateral cross section forming a generally teardrop shaped outlet in a convex contour of said suction sidewall.

12. A blade accordingly to claim 11 wherein said first holes each includes a uniform inlet extending through said suction sidewall from said first passage, followed in turn by said teardrop outlet diverging therefrom.

13. A blade accordingly to claim 12 wherein said teardrop outlet includes a substantially straight side aligned along said airfoil span in said row of first holes, and two inclined sides extending therefrom toward said leading edge and joined together by an arcuate side along

said convex contour.

14. A blade accordingly to claim 13 further comprising a row of diffusion film cooling second holes extending through said suction sidewall adjacent to said row of first holes, and said second holes being disposed through said suction sidewall at a compound inclination angle with a quadrilateral cross section forming a generally teardrop shaped outlet in said convex contour of said suction sidewall.

15. A blade accordingly to claim 14 wherein said second holes each includes a uniform inlet extending through said suction sidewall from said first passage, followed in turn by said teardrop outlet diverging therefrom.

16. A blade accordingly to claim 15 wherein said teardrop outlet of said second holes includes a substantially straight side aligned along said airfoil span in said row of second holes, and two inclined sides extending therefrom toward said leading edge and joined together by an arcuate side along said convex contour.

17. A blade accordingly to claim 16 wherein said row of second holes is staggered with said row of first holes along said airfoil span.

18. A blade accordingly to claim 17 wherein said first and second holes overlap along said airfoil span to provide a continuous line of film cooling air discharged therefrom along said airfoil suction sidewall.

19. A blade accordingly to claim 18 wherein said first and second holes have substantially equal outward inclination span angles along said airfoil span greater than about 45 degrees, with said outlets being closer to said tip than said corresponding inlets.

20. A blade accordingly to claim 19 wherein said first and second holes have different inclination chord angles along said suction sidewall greater than about 45 degrees, with said

outlets being closer to said trailing edge than said corresponding inlets.

21. A blade accordingly to claim 20 wherein said first holes are disposed closer to said leading edge, and said second holes are disposed closer to said bridge.

22. A blade accordingly to claim 20 wherein:
said first and second holes have inclination span angles of about 48 degrees;
said first holes have inclination chord angles of about 59 degrees; and
said second holes have inclination chord angles of about 46 degrees.

23. A blade accordingly to claim 22 wherein:
said row of first holes consists of twelve holes; and
said row of second holes consists of thirteen holes.

24. A blade accordingly to claim 23 wherein said teardrop outlets of said first and second holes have rectangular cross sections diverging at about ten degrees in one plane, and at about 20 degrees along an orthogonal plane.

25. A blade accordingly to claim 20 further comprising thermal barrier coating covering external surfaces of said airfoil pressure and suction sidewalls, with said teardrop outlets extending therethrough.

26. A blade accordingly to claim 20 wherein:

said airfoil tip includes squealer ribs extending outwardly from said pressure and suction sidewalls forming a recessed tip floor therebetween;

said tip floor includes rows of floor holes along both said pressure and suction sidewalls inboard of said squealer ribs; and

said pressure sidewall includes an axial row of tip holes disposed below said squealer rib thereat.

27. A blade accordingly to claim 26 wherein said tip floor includes eight floor holes along said pressure sidewall, seven floor holes along said suction sidewall, and a common floor hole midway therebetween at the aft end of said tip floor.